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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : B65H 63/06, 63/032, G01N 33/36 — A1

(11) International Publication Number: **WO 99/35075**

(43) International Publication Date: 15 July 1999 (15.07.99)

(21) International Application Number: PCT/EP98/08510

(22) International Filing Date: 30 December 1998 (30.12.98)

(30) Priority Data:
PI98A000001 2 January 1998 (02.01.98) IT

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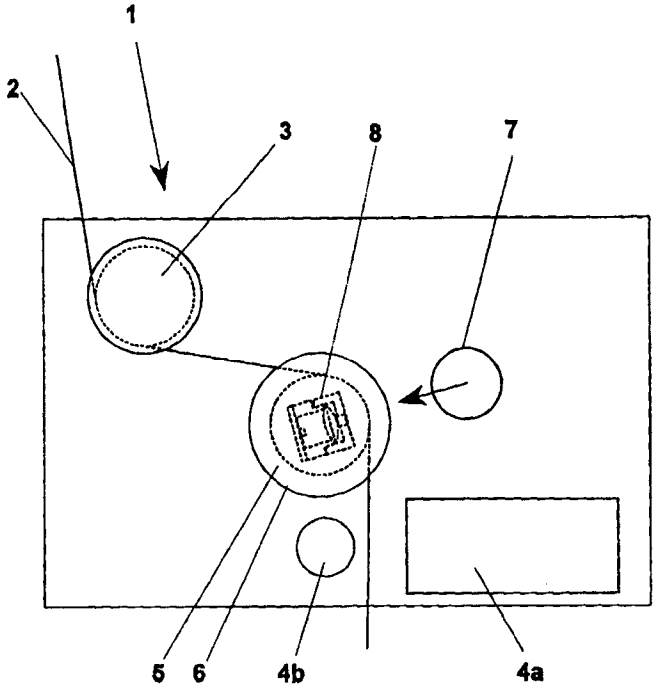
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: METHOD AND APPARATUS FOR DETECTING YARN DEFECTS DURING PRODUCTION, IN PARTICULAR CHENILLE YARNS

(57) Abstract

An apparatus for detecting defects on a yarn (2) during production comprises a detecting device (1) and, respectively upstream and downstream of it, braking deflector means (3) of the yarn (2) and cutting means (4a, 4b) of the yarn (2). The apparatus (1) comprises a drum (5), located between two shoulders (6), on which the yarn (2) passes substantially stretched and partially wound on the drum (5) so that it is pressed against its surface and the helix effect reduced. Light emitting means (7) are provided outside the drum (5), which is transparent and comprises inside an optical sensor (8). This way the light beam coming from the emitting means (7) projects the yarn (2) on the optical sensor (8), that detects continuously the amplitude of its shadow. When the optical sensor (8) detects an increase or decrease of transversal size of the yarn (2), beyond a predetermined threshold value, the yarn is stopped, is cut and then is joined again after having eliminated the defective portion. The apparatus (1) is particularly suitable for detecting defects on chenille yarns or fancy yarns.



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TITLE

METHOD AND APPARATUS FOR DETECTING YARN DEFECTS DURING PRODUCTION, IN PARTICULAR CHENILLE YARNS.

DESCRIPTION

Field of the invention

The present invention generally relates the field of textiles and more precisely it relates to a method for detecting yarn defects during production. In particular the invention, but not exclusively, relates to the detection of yarns defects of chenille yarns, fancy yarns and the like.

Moreover, the invention relates to an apparatus that carries out such method.

Description of the prior art

Chenille yarns defects, as well as defects of other yarns having high count, may be classified as long defects or short defects. As count of yarn is normally indicated the meters of yarn necessary for making 1 kg of yarn.

Long defects are an increase or a decrease beyond a certain rate of the nominal count of yarn measured on a long portion of yarn.

Short defects, peculiar to chenille, may be classified as "fault" and "burl". The former corresponds to a concentrated decrease of the count of yarn, that in the case of chenille is due to lack of transversal yarn, whereas chenille "burl" defects are due to local thickening of transversal yarns or to transversal yarns of increased length.

A yarn of good quality must be without both long defects and short defects. In particular, if during production defects are detected, the yarn must be cut, the machine must be stopped and the continuity of the yarn must be restored, after having eliminated the defective

portion.

Many devices exist to be mounted on yarn production machines capable of detecting long defects of decrease of count of yarn as well as short defects of "fault". These devices, also called "clearers", use optical sensors that detect the shadow of the yarn projected by a light source when the yarn passes at high speed (up to 600 m/min).

A first problem that arises from these devices is the need of optical sensors, such as high-definition photodiodes having large active area and then very expensive.

A second problem is that, in the case of chenille yarn, its helical shape does not allow the use of these devices which, since they project a shadow, detect wrongly a defect when the plane containing a portion of yarn of chenille is parallel to the light source.

These devices, moreover, are not capable of detecting defects of "burl".

Summary of the invention

It is object of the present invention to provide an apparatus for detecting defects in yarns, in particular but not exclusively chenille yarns or fancy yarns, that is capable of overcoming the existing problems of the prior art above described.

It is another object of the present invention to provide an apparatus for detecting both defects of burl and of fault as well as chenille yarns long defects that the device of the prior art are not capable of detecting all together.

It is moreover object of the present invention to provide an apparatus for detecting defects on a yarn that carries out the method according to the previous objects.

It is a particular object of the apparatus according to the invention the detection of defects with at least

the same definition of the existing ones, but with a less expensive construction.

These and other objects are achieved by the apparatus and by the method for detecting defects on a yarn according to the present invention.

The apparatus is characterised in that it comprises:

- a transparent curved surface on which the yarn can slide;
- dragging means capable of causing said yarn to slide against said transparent curved surface, to reduce the helix effect of the yarn;
- optical sensor means and a light source located at opposite sides with respect to the transparent surface;
- a computing unit connected to the optical sensor means capable of analysing and controlling the shadow projected by the light source onto the optical sensor means through the transparent surface as well as of operating the stop of the yarn when defects are detected.

Preferably, the computing unit comprises hardware means for analysing the shadow and for operating the stop of the yarn.

Alternatively, the computing unit comprises software means for analysing the shadow and for operating the stop of the yarn.

Advantageously, the transparent surface is associated to lens means capable of concentrating the image projected by the light source onto the sensor means.

Always advantageously, between the transparent surface and the optical sensor means a slit is present transversal to the direction of the yarn, capable of increasing the precision of defect recognition. Preferably, said slit is located between the transparent surface and the lens means and has a thickness comprised between 0,2 mm and 2 mm.

In an embodiment particularly suitable for the control of chenille, the software means residing in said computing unit comprises means for storing the profile of the yarn as projected onto the sensor means versus time and means for subtracting the stored profile from the real image of the yarn as projected onto the sensor means, whereby the defects are distinguished from the comparison of the stored profile with respect to the real image.

The method for detecting defects has the characteristic that it comprises the steps of:

- dragging the yarn between a light source and an optical sensor;
- stretching and pressing the yarn on a curved transparent surface located between the light source and the optical sensor, the yarn sliding on the transparent curved surface;
- detecting the shadow of the yarn projected by the light source on the optical sensor through the transparent curved surface;
- checking the shadow and stopping the dragging at the detection of a defect, with cut and removal of the defective portion.

Advantageously, the step of detecting comprises a step of focusing the shadow on the optical sensor.

Always advantageously, the step of detecting comprises a step of passage of the shadow through a slit transversal to the direction of the yarn, for increasing the precision of defect recognition.

Preferably the step of analysing the shadow of the yarn comprises the step of storing the profile versus time of the yarn as projected onto the sensor means and subtracting the stored profile from the real image of the yarn as projected onto the sensor means, whereby the defects are distinguished after the comparison of the

stored profile with respect to the real image.

Brief description of the drawings

Further characteristics and advantages of the apparatus for detecting defects of a yarn and of the corresponding method according to the invention will be made clearer with the following, but not limitative, exemplifying description with reference to the attached drawings, wherein:

- figure 1 shows a diagrammatical view of an apparatus for detecting defects on a yarn which can be arranged on a machine for the production of said yarn;
- figures 2A and 2B show respectively an elevational and cross sectional view of a tubular transparent element on which said yarn slides;
- figures 3A and 3B show respectively a defect of "fault" and of "burl" in a yarn of chenille;
- figure 4 shows a cross sectional view of an optical apparatus comprising a lens suitable for being inserted into said tubular transparent element;
- figure 4A shows a different embodiment of the optical apparatus of figure 4 comprising a slit transversal to the yarn for filtering the light;
- figure 5 shows in a diagrammatic view the hardware of a control unit of the yarn associated to an optical sensor;
- figures 6, 7 and 8 show three types of signal respectively input, intermediate and output signals of the control unit of figure 5;
- figure 9 shows a flux diagram of software means residing in a microprocessor computing unit connected to said optical sensor means.

Description of the preferred embodiments

With reference to figure 1, an apparatus for detecting defects on a yarn 2 during production comprises a detecting device 1 and, respectively upstream and

downstream of it, braking deflector means 3 of yarn 2 and cutting means 4a and 4b of yarn 2.

In more detail, apparatus 1 comprises a drum 5, located between two shoulders 6, on which yarn 2 passes.

According to the invention, yarn 2 passes substantially stretched and partially wound on drum 5 so that it is pressed against its surface.

Light emitting means 7 are provided outside drum 5, which, always according to the invention, is transparent and comprises inside an optical sensor 8. This way the light beam coming from the emitting means 7 projects yarn 2 on optical sensor 8, that detects continuously the amplitude of its shadow.

When optical sensor 8 detects an increase or decrease of transversal size of yarn 2, beyond a certain a predetermined threshold value, the yarn is stopped and cut and then joined again after having eliminated the defective portion.

The apparatus 1 according to the present invention is particularly suitable for detecting defects on chenille yarns, as shown in figures 2A, 2B. In fact, a yarn of chenille, which as shown is formed by a longitudinal yarn 9 from which portions 10 of yarn project transversally, extends substantially as an helix and then its image projected is not constant although the yarn is without defects.

The stretching action of the chenille yarn 2 on drum 5 causes, as shown in figure 2B, a pressing effect on a cylindrical surface of the transversal portions 10 of yarn, that would otherwise normally arrange according to an helix. This way a substantially homogeneous strip-like shadow is created.

With respect to the prior art, in which the yarn is not pressed on a surface during the step of detecting

defects, according to the present invention it is possible to detect defects of "fault", as those shown in figure 3A, without the risk of confusion. Otherwise this confusion could occur in case of transversal yarns 10 locally parallel to the light beam 7 that illuminates yarn 2.

The need, then, for the yarn of chenille of being projected integrally is very expensive because it requires optical sensors with large surface, for example large area photodiodes, because it is necessary to detect the whole shadow of the yarn. This aspect is particularly important for detecting the defects of "burl" of a yarn of chenille as that shown in figure 3B.

In a preferred embodiment of the invention, shown in figure 4, optical sensor 8 comprises a support 15 for a lens 16 located between a slit 17 and an optical sensor 18. Sensor 18, for the presence of lens 16, does not need a very large area, even if its precision is the same as a sensor having a much larger detecting area.

Preferably, slit 17 is transversal to yarn 2 and has a width set between 0,2 and 2 mm. This way, the projection of the shadow of the yarn on the optical sensor is substantially filtered by slit 17, thus making easier the recognition of defects by the optical sensor. With width comprised between 0,4 and 0,6 mm the maximum values of precision of recognition has been met.

As shown in figure 4A, according to a preferred embodiment of the invention, to the sensor of figure 4 a bush 19 has been added comprising a slit 19a between the transparent drum 5 and the lens 16 transversally to the yarn, in particular orthogonal to it. This way, the projection of the yarn shadow on the optical sensor is filtered by slit 19a, instead of slit 17 which can be of whichever larger size, or be lacking. Even in this embodiment, preferably, slit 19a has a width comprised

between 0,2 and 2 mm. In particular with width comprised between 0,4 and 0,6 mm the maximum values of precision of recognition have been met.

Optical sensor 18 is connected to a computing unit, not shown, comprising an detecting apparatus like that of figure 5. It has a low-pass filter 20 with adjustable frequency of cut. Filter 20, in case the speed of the chenille being detected is enough, has an input signal like that shown in figure 6 and gives the output signal of figure 7. After differentiation versus time of the signal of figure 7 by means of an operational amplifier 21, an output signal like that of figure 8 results, that can be checked by an adjustable window comparator 22, for recognising the defect of fault or of burl. This is possible, in particular, since operational amplifier 21, beyond signalling the defect, clears the mean value, thus creating an absolute reference starting from which the threshold of the comparator is set, said reference being a voltage equal to zero.

Instead of the apparatus of figure 5, according to a different embodiment of the invention, it is possible to provide software means that reside in the computing unit and that analyse a signal resulting from an analogue to digital converter and a microprocessor, known in the art. In figure 9 a flux diagram is shown of such microprocessor comprising the successive steps for analysing each input signal of the array of digital signals coming from the photodiode. These signals, which are the output of the analogue to digital converter, are indicated as AD.

In more detail, the software means according to the flux diagram of figure 9 carry out the reduction of the helix effect of the chenille during the sliding thereof on the optical system. In a first step of the calculus the variables ARRAY(), SUM, and "i" are reset. ARRAY() is a

vector having N positions which has the function of storing the values AD acquired from the analogue to digital converter A/D. SUM is a variable that sums the values of ARRAY() and "i" is the index of the actual location of ARRAY(). After having cleared the variables ARRAY(i), SUM and "i", each value of AD is stored in ARRAY(i), and is added to the previous value of SUM and of ARRAY(i). Then, the mean value Vm of SUM is calculated and the index "i" is incremented, checking that it is not greater than the maximum dimension N of ARRAY(i). Then the value Vo is calculated subtracting Vm from AD. Vo is the value to compare with the threshold values indicated as THRESHOLD L, for the defect of "fault" and as THRESHOLD N, for the defect of "burl". If Vo is external to values THRESHOLD L and THRESHOLD N, the microprocessor operates the cut of the yarn, otherwise it continues to repeat the above indicated calculus.

The foregoing description of the specific embodiments will so fully reveal the general nature of the invention that others can, by applying current knowledge, readily modify and/or adapt for various applications such specific embodiments without undue experimentation and without departing from the generic concept, and, therefore, such adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments. The means and materials for carrying out various disclosed functions may take to variety of alternative forms without departing from the invention. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

CLAIMS

1. Apparatus for detecting defects on a yarn characterised in that it comprises:

- a transparent curved surface;
- dragging means capable of causing said yarn to slide against said transparent curved surface, to reduce the helix effect of the yarn;
- optical sensor means and a light source located at opposite sides of said transparent curved surface;
- a computing unit connected to said optical sensor means capable of analysing and controlling the shadow of said yarn projected by said light source on said optical sensor means through said curved transparent surface and to operate the stop of said dragging means and the cut of said yarn when said defects are detected.

2. Apparatus according to claim 1, wherein said transparent curved surface is associated to lens means capable of concentrating the image projected onto said sensor means from said light source.

3. Apparatus according to claims 1 or 2, wherein between said transparent curved surface and said optical sensor means a slit transversal to the direction of the yarn is present, capable of increasing the precision of defect recognition.

4. Apparatus according to claim 3, wherein said slit has a thickness comprised between 0,2 mm and 2 mm.

5. Apparatus according to claim 1, wherein said computing unit comprises hardware means for analysing the shadow and for operating the stop of said yarn.

6. Apparatus according to claim 5, wherein said hardware means comprises:

- a low-pass filter with adjustable frequency of cut;
- a first operational amplifier for differentiating versus time the output signal of said filter;

- a second operational amplifier for subtracting said differentiated signal from the mean value of the output signal of said filter and for recognising a defect of fault or of burl after comparing it with a threshold value.

7. Apparatus according to claim 1, wherein said computing unit comprises software means residing in it for analysing the shadow of said yarn and for operating the stop of said yarn.

8. Apparatus according to claim 7, wherein said software means comprises means for storing the profile versus time of said yarn as projected onto said sensor means and means for subtracting said stored profile from the real image of said yarn as projected on said sensor means, said defects being obtained from the comparison of said stored profile with respect to said real image.

9. Apparatus according to claims 7 and 8, wherein said software means have a flux of calculus for the reduction of the helix effect of the yarn according to the following steps:

- definition of variables ARRAY(), SUM, and "i", wherein ARRAY() is a vector having N positions and has the function of storing AD values acquired from a analogue to digital converter A/D, SUM is a variable that stores the sum of the values of ARRAY() and "i" is the index of the actual location of ARRAY();
- initial clearing of the variables ARRAY(), SUM and "i";
- association of each value of AD to ARRAY(i), and addition thereof to the previous value of SUM and of ARRAY(i);
- calculus of the mean value Vm of SUM and increment of the index "i", checking that it is not greater than the maximum dimension N of ARRAY();
- calculus of a value Vo subtracting Vm from AD;
- comparison of Vo with threshold values indicated with

THRESHOLD L, for the defect of "fault" and with THRESHOLD N, for the defect of "burl";

- repetition of the calculus or operation of the cut of the yarn if Vo is external to values THRESHOLD L and THRESHOLD N.

10. Method for detecting defects on a yarn characterised in that it comprises the steps of:

- dragging said yarn between a light source and an optical sensor;
- stretching and pressing said yarn on a curved transparent surface located between said light source and said optical sensor, said yarn sliding with high speed on said transparent curved surface;
- detecting the shadow projected by said light source onto said optical sensor through said transparent curved surface;
- checking said projected shadow and stopping said dragging at the detection of a said defect.

11. Method for detecting defects according to claim 10, wherein said step of detecting comprises a step of focusing said shadow on said optical sensor.

12. Method for detecting defects according to claims 10 or 11, wherein said step of detecting comprises a step of passage of the shadow through a slit transversal to the direction of the yarn, for increasing the precision of defect recognition.

13. Method for detecting defects according to claim 10, wherein said step of analysing said projected shadow comprises the step of storing the profile versus time of said yarn as projected on said sensor means and subtracting said stored profile from the real image of said yarn as projected onto said sensor means, whereby said defects are obtained from the comparison of said stored profile with respect to said real image.

Fig. 1

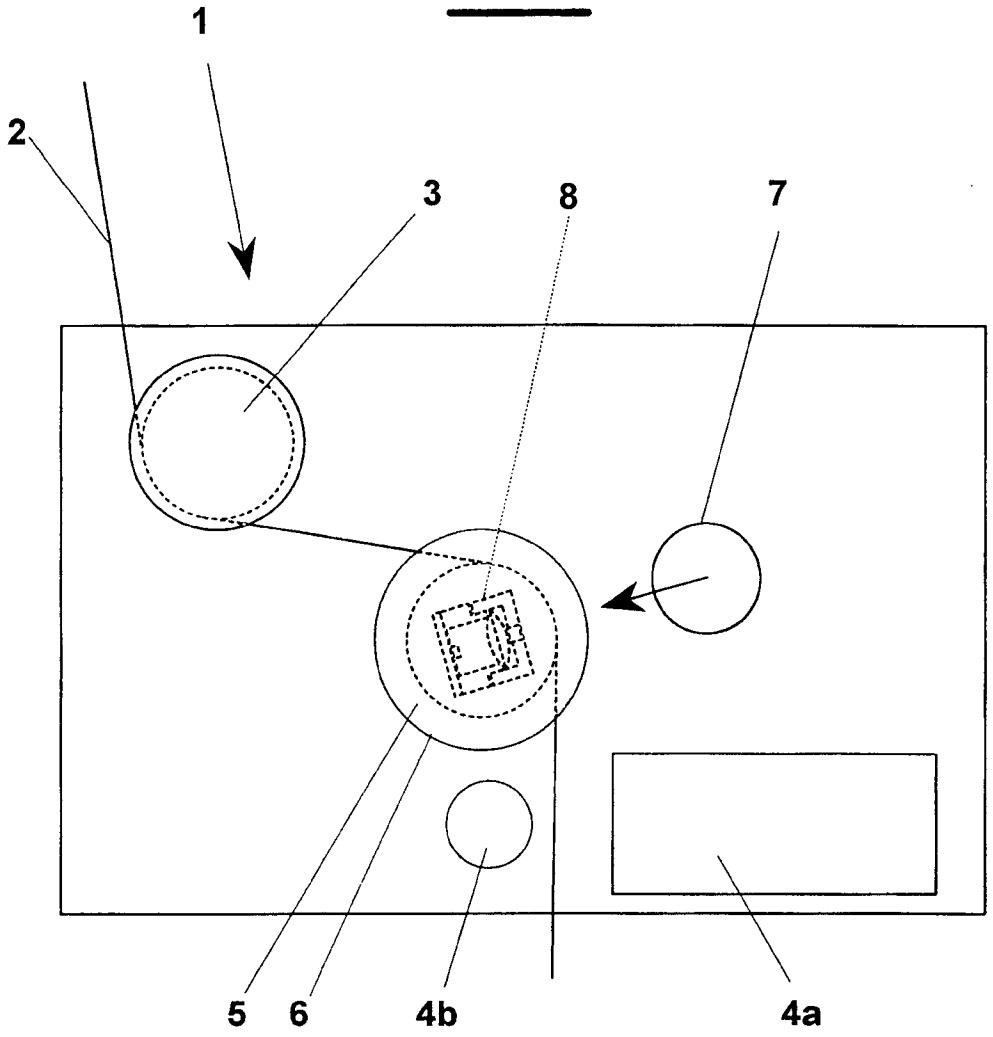


Fig. 2A

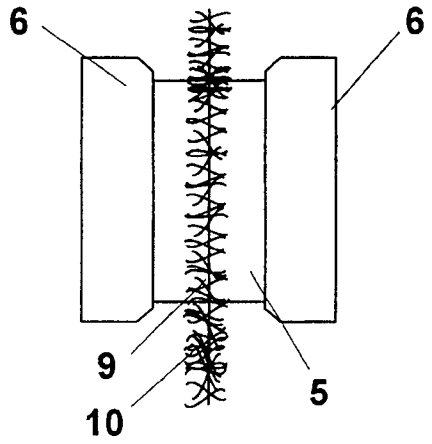
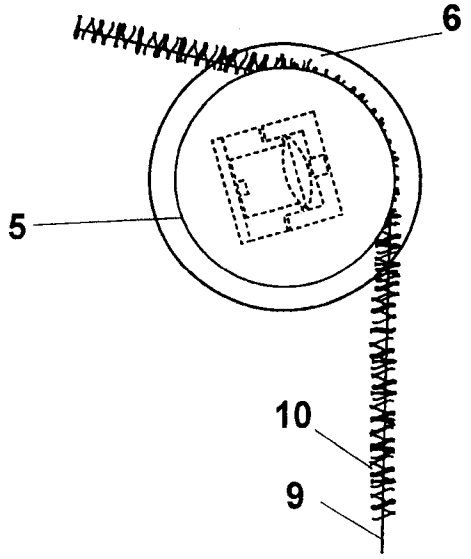


Fig. 2B



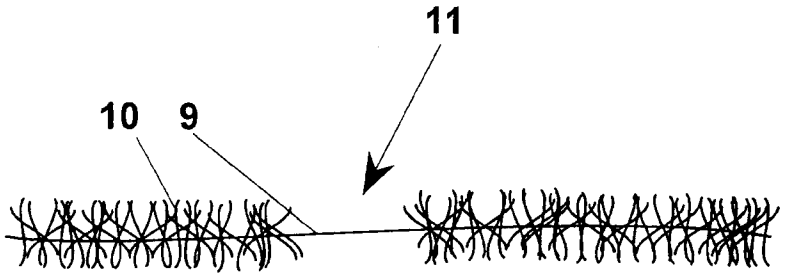


Fig. 3A

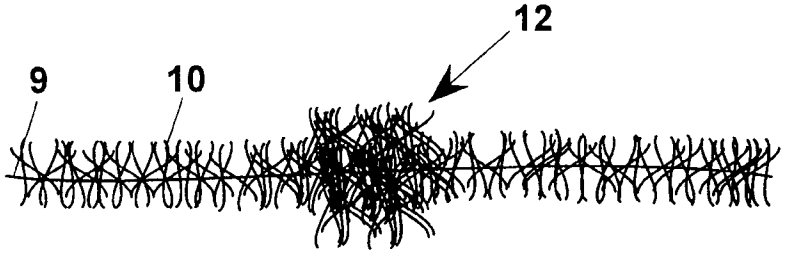


Fig. 3B

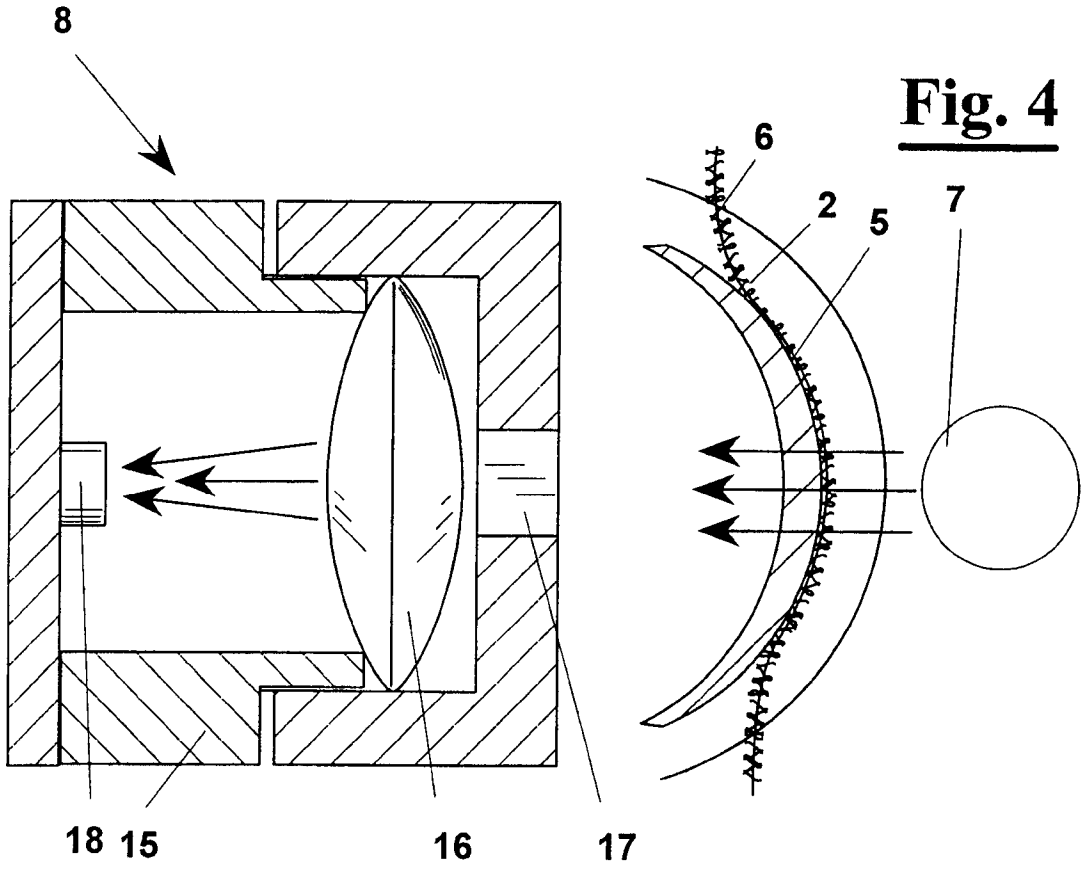


Fig. 4

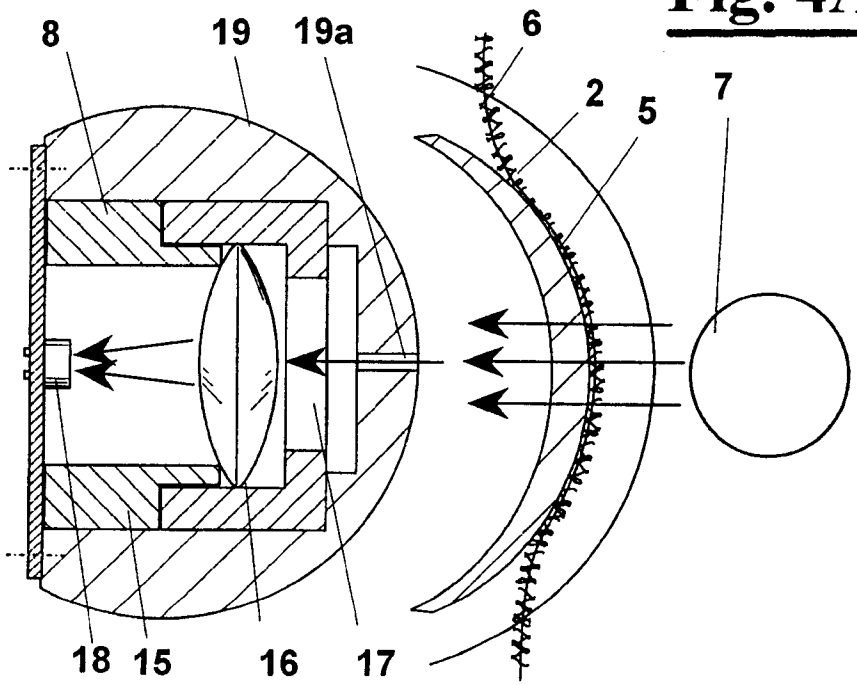


Fig. 4A

Fig. 5

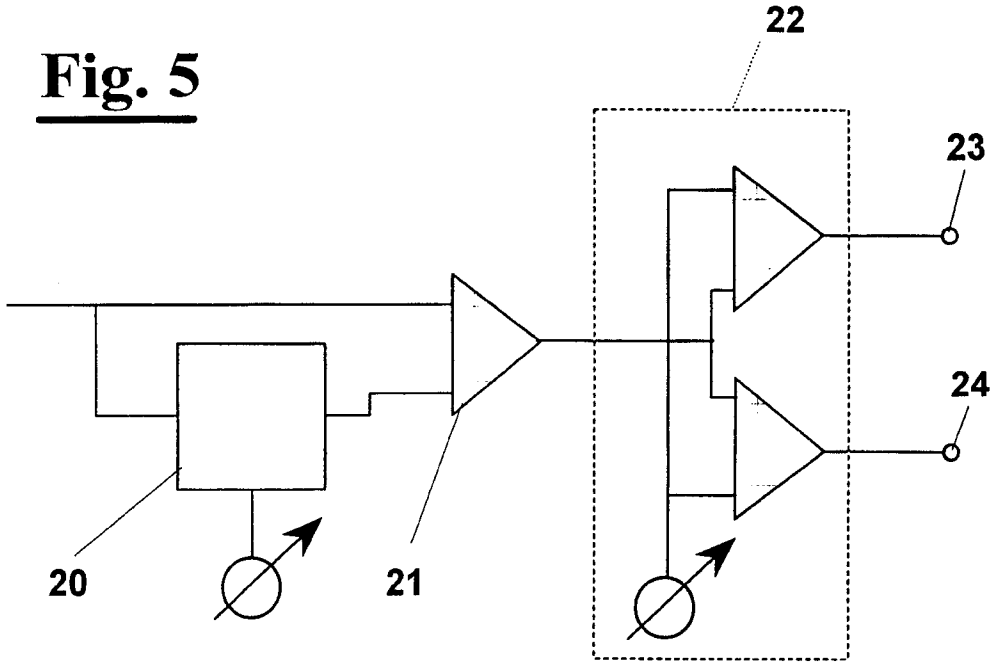


Fig. 6

Fig. 7

Fig. 8

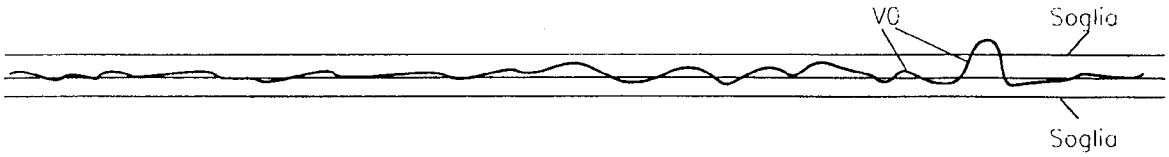
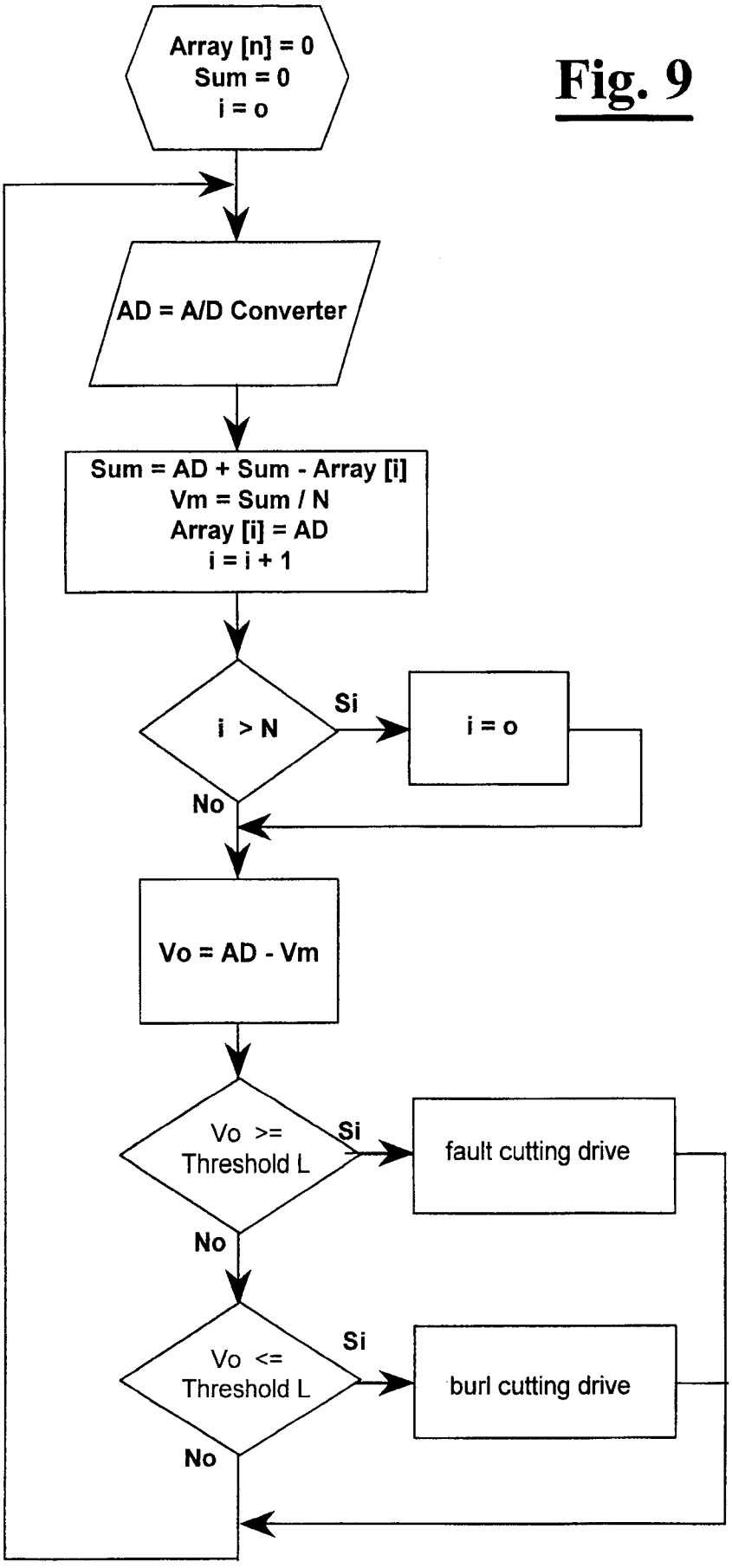


Fig. 9


Array [n] = 0
Sum = 0
i = o
AD = A/D Converter
Sum = AD + Sum - Array [i]
Vm = Sum / N
Array [i] = AD
i = i + 1
i > N
Si
i = o
No
Vo = AD - Vm
Vo >= Threshold L
Si
fault cutting drive
No
Vo <= Threshold L
Si
burl cutting drive
No

INTERNATIONAL SEARCH REPORT

Int tional Application No
PCT/EP 98/08510

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B65H63/06 B65H63/032 G01N33/36

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B65H G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 41 22 305 A (SIPRA PATENT BETEILIGUNG) 7 January 1993 see claim 1	1,10
A	PATENT ABSTRACTS OF JAPAN vol. 012, no. 251 (M-718), 15 July 1988 & JP 63 037082 A (GUNZE LTD), 17 February 1988 see abstract	1,10
A	US 4 341 958 A (OHSAWA SHIUJIA) 27 July 1982 see claim 1	1,10
A	EP 0 650 915 A (LUWA AG ZELLWEGER) 3 May 1995 see the whole document	1-13

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Date of the actual completion of the international search	Date of mailing of the international search report
27 May 1999	08/06/1999

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ional Application No
PCT/EP 98/08510

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 4122305 A	07-01-1993	NONE	
US 4341958 A	27-07-1982	GB 2092187 A,B	11-08-1982
EP 0650915 A	03-05-1995	CH 686779 A	28-06-1996
		CN 1106536 A	09-08-1995
		JP 7172699 A	11-07-1995
		US 5636803 A	10-06-1997